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Costs and efficiency in the English higher education sector (0018)

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**Background:** Higher education institutions (HEIs) are complex organisations, using costly inputs to produce a multiplicity of outputs. These outputs include teaching (at various levels) in a wide variety of disciplines, research and third mission outputs. This plethora of outputs is typically produced within the context of a university because there exist synergies (i.e. economies of scope) between many of the outputs. Likewise, a variety of subject areas is typically provided within a single institution, because disciplinary boundaries are permeable. This was recognised ([Baumol et al. 1982](#)).

As a consequence of the current economic climate, the higher education sector in England is facing an alternative funding regime, and is under pressure to use any public funds efficiently. These alterations in funding follow radical changes in the composition of the English higher education sector: since 2003 colleges of higher education (often, but are by no means always, specialist institutions concentrating on a particular discipline such as teacher training, music, drama, performing arts) have been allowed to apply for university (and degree-awarding) status. Thus the sector is now highly diverse comprising traditional (pre-1992) universities, post-1992 universities (former polytechnics which, by the Higher Education Act of 1992, were allowed to use the title of university), and former colleges of higher education. Previous work on cost structure and efficiency in the English higher education sector is out of date and does not represent the sector we see today ([Glass et al. 1995a](#); [1995b](#); [Izadi et al. 2002](#); [Johnes et al. 2005](#); [Stevens 2005](#); [Johnes et al. 2008](#); [Johnes and Johnes 2009](#); [Thanassoulis et al. 2011](#)).

**Purpose:** The purpose of this paper is to provide an in-depth study of the cost structure and efficiency of HEIs. We are particularly interested, given the change in the composition of the sector, in how cost structures and efficiency vary by mission group. Previous work has focussed on pre-determined mission groups; but that is not necessarily satisfactory as mission groups were often formed historically, and universities which may once have had similar missions may not necessarily have similar outlooks today. To this end we use a panel of data from the English higher education sector from 2002/03 to 2010/11, in order to estimate a cost function for English HEIs using the latent class variant of the stochastic frontier model (Greene 2002; Caudill 2003; Orea and Kumbhakar 2004). This allows us simultaneously to (i) identify clusters of institutions, based on what the data tell us, (ii) evaluate the parameters of the cost function for each cluster, thence evaluating also measures of economies of scope and of scale within each cluster, and (iii) measure the efficiency of each institution, both relative to other institutions in the same cluster and relative to all other institutions in the analysis.

**Approach:** A latent class model is one in which two or more separate sets of parameters of an equation (such as a cost equation) are estimated. Each set represents a fit to the equation that pertains to a subsample of observations. The membership of each observation in each set is determined in such a way as to maximise the likelihood that the model parameters (and membership of sets) describes the data.

The latent class stochastic cost frontier model is expressed as:

$$C_{it} | j = \sum_k \beta_k x_{itk} + v_{it} - u_{it}$$
$$v_i | j = N[0, \sigma_v^2]$$
$$u_i | j = |N[\sigma_u^2]|$$

where  $C$  denotes costs,  $x$  is a vector of outputs,  $v$  is the normal residual and  $u$  is the non-normal residual which provides a measure of efficiency. The  $j$  represent the classes,  $j=1,\dots,J$ . The model is solved using maximum likelihood methods.

**Findings:** The analysis finds that efficiency and economies of scale and scope vary by group where the groups are identified by the latent class method. Further examination on how the environment of HEIs in each class differs is also possible because of the availability of data such as: student quality, student satisfaction, commitment to widening participation, and age of estate.

**Contribution:** This is the first application of a latent class stochastic frontier model to the English higher education sector. The specification is more detailed than in previous studies in that undergraduate students are split by broad subject group, and a more satisfactory measure of third mission activity (relating to business and community interaction) is used. Finally, this is the first study to examine the effect on cost structure of factors such as student satisfaction, widening participation and age of estate.

### References:

- Baumol, W. J., J. C. Panzar and R. D. Willig (1982). *Contestable Markets and the Theory of Industry Structure*. London, Harcourt Brace Jovanovich.
- Glass, J. C., D. G. McKillop and N. S. Hyndman (1995a). 'The achievement of scale efficiency in UK universities: a multiple-input multiple-output analysis' *Education Economics* 3(3): 249-263.
- Glass, J. C., D. G. McKillop and N. S. Hyndman (1995b). 'Efficiency in the provision of university teaching and research: an empirical analysis of UK universities.' *Journal of Applied Econometrics* 10(1): 61-72.
- Izadi, H., G. Johnes, R. Oskrochi and R. Crouchley (2002). 'Stochastic frontier estimation of a CES cost function: the case of higher education in Britain.' *Economics of Education Review* 21(1): 63-71.
- Johnes, G. and J. Johnes (2009). 'Higher education institutions' costs and efficiency: taking the decomposition a further step.' *Economics of Education Review* 28(1): 107-113.
- Johnes, G., J. Johnes and E. Thanassoulis (2008). 'An analysis of costs in institutions of higher education in England.' *Studies in Higher Education* 33(5): 527-549.
- Johnes, G., J. Johnes, E. Thanassoulis, P. Lenton and A. Emrouznejad (2005). *An Exploratory Analysis of the Cost Structure of Higher Education in England*. London, Department for Education and Skills.
- Stevens, P. A. (2005). 'A stochastic frontier analysis of English and Welsh universities.' *Education Economics* 13(4): 355-374.
- Thanassoulis, E., M. Kortelainen, G. Johnes and J. Johnes (2011). 'Costs and efficiency of higher education institutions in England: A DEA analysis.' *Journal of the Operational Research Society* 62(7): 1282-1297.